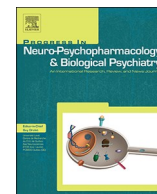




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Psychological effects caused by the COVID-19 pandemic in health professionals: A systematic review with meta-analysis

Raimundo Monteiro da Silva Neto^a, Cicero Jonas Rodrigues Benjamim^b,
Poliana Moreira de Medeiros Carvalho^c, Modesto Leite Rolim Neto^{d,*}

^a Nursing Course, Centro Universitário de Juazeiro do Norte (UNIJUAZEIRO), Juazeiro do Norte, CE, Brazil

^b Development, Nutrition, Phytotherapy and Hygiene Research Group, Universidade de Pernambuco (UPE), Petrolina, PE, Brazil

^c Postgraduate Program in Health Sciences, Faculdade de Medicina do ABC (FMABC), Santo André, SP, Brazil

^d School of Medicine, Universidade Federal do Cariri (UFCA), Barbalha, CE, Brazil

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ABSTRACT

Background: Psychological suffering by health professionals may be associated with the uncertainty of a safe workplace. Front-line professionals exposed and involved in the diagnosis and treatment of COVID-19 patients are more susceptible.

Method: This review was conducted based on papers that were published at MEDLINE, BMJ, PsycINFO, and LILACS, the according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

Results: Health professionals had a higher level of anxiety (13.0 vs. 8.5%, $p < 0.01$, OR = 1.6152; 95%CI 1.3283 to 1.9641; $p < 0.0001$) and depression 12.2 vs. 9.5%; $p = 0.04$; OR = 1.3246; 95%CI 1.0930 to 1.6053; $p = 0.0042$), besides somatizations and insomnia compared to professionals from other areas.

Conclusion: Health professionals, regardless of their age, showed significant levels of mental disorders. We observed a prevalence of anxiety and depression. Insomnia was a risk factor for both.

1. Introduction

Uncertain conditions in healthcare reflect on behavioral changes and disfavor the mental health of people working to save lives. The new coronavirus (COVID-19) has quickly spread from Wuhan, China, to the world (Ahmed et al., 2020; Lunn et al., 2020). Since the virus was first identified until the moment this study was carried out, there have been more than 3,450,000 confirmed cases spread around the globe (Corona Virus Diagnostipedia, 2020). Thus, health professionals face higher work demand and risks to their physical and mental integrity, and the virus was able to cause large psychological impacts at a short period of time (Zhang et al., 2020a).

The lack of an effective treatment is still one of the greatest challenges for professionals who work to heal patients and fear the disease. This fear usually favors the development of anxiety, insomnia, depression, frustrations, and hysteria (Shigemura et al., 2020; Lu et al., 2020; Liu et al., 2020). During the COVID-19 pandemic, health professionals have been showing some psychosocial problems, as well as higher risk factors for developing them (Zhang et al., 2020a).

Reasons for the psychological suffering of health professionals may be associated with the uncertainty of a safe workplace, irritability,

insomnia, sadness, demoralization (Guangming and Grupo Diretor Central, 2020; Theorell, 2012) and little time to rest, in addition to exhaustion due to the increasingly higher number of cases (Ryall, 2020). There are many reports in literature showing that front-line professionals exposed and involved in the diagnosis and treatment of COVID-19 patients are more susceptible compared to people who are not dealing directly with these patients (Lu et al., 2020). Thus, the following question was raised: What are the main impacts of the COVID-19 pandemic on the mental health of health professionals?

People working in health services against COVID-19 show significant mental health burnout and, therefore, present a high prevalence of mental disorders during the COVID-19 pandemic. This study aimed at analyzing the main psychological effects caused by the COVID-19 pandemic in health professionals.

2. Method

This review was conducted by means of a systematized search in April and May 2020 based on papers that were published and are available at MEDLINE, BMJ, PsycINFO, and LILACS. The review was carried out according to the Preferred Reporting Items for Systematic

* Corresponding author at: School of Medicine, Universidade Federal do Cariri (UFCA), 284, Divine Savior Street, Downtown, Barbalha, Ceará 63180000, Brazil.
E-mail address: modesto.neto@ufca.edu.br (M.L.R. Neto).

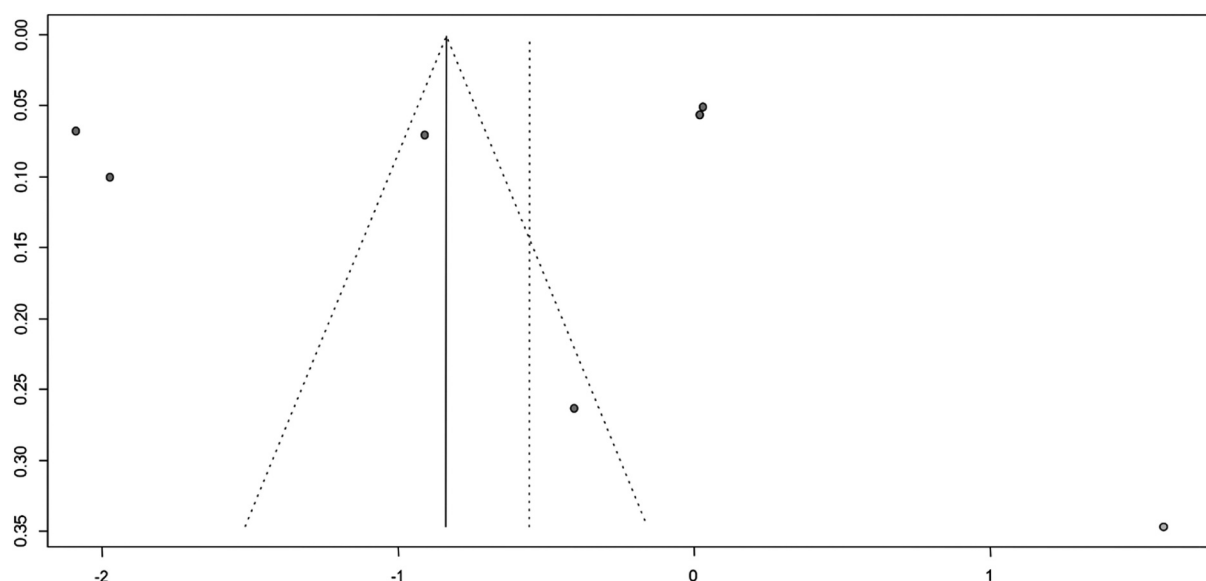


Fig. 1. Funnel plot of studies that assessed anxiety and depression in health professionals during the COVID-19 pandemic (risk of bias).

1 LIANG, 2020			6 LIANG, 2020		
	Anxiety	Without anxiety		Depression	Without depression
TMY	17	42	TMY	18	41
OMT	16	43	OMT	17	42
OR=1.0878 95% CI 0.4867 to 2.4313 $p=0.8375$			OR=1.0846 95% CI 0.4921 to 2.3906 $p=0.8403$		
2 XU, 2020			7 XU, 2020		
	Anxiety	Without anxiety		Depression	Without depression
OHP	28	32	PHO	7	53
HPNO	6	54	PHNO	4	56
OR=7.8750 95% CI 2.9432 to 21.0710 $p<0.000$			OR=1.8491 95% CI 0.5117 to 6.6813 $p=0.3483$		
3 LU, 2020			8 LU, 2020		
	Anxiety	Without anxiety		Depression	Without depression
TMA	572	1670	TMD	271	1971
ASWA	484	1758	ASD	267	1975
OR=1.2441 95% CI 1.0834 to 1.4287 $p=0.0020$			OR=1.0170 95% CI 0.8494 to 1.2178 $p=0.8541$		
4 ZHANG, 2020			9 ZHANG, 2020		
	Anxiety	Without anxiety		Depression	Without depression
HTA	284	1898	DHT	266	1916
HTWA	185	1997	HTWD	207	1975
OR=1.6152 95% CI 1.3283 to 1.9641 $p<0.0001$			OR=1.3246 95% CI 1.0930 to 1.6053 $p=0.0042$		
5 ZHANG b, 2020			10 ZHANG b, 2020		
	Anxiety	Without anxiety		Depression	Without depression
MTIA	618	945	MTID	618	945
MSWIA	72	1492	MSWID	72	1492
OR= 13.5517 95% CI 10.4771 to 17.5285 $p<0.0001$			OR= 13.5517 95% CI 10.4771 to 17.5285 $p<0.0001$		

Fig. 2. Odds Ratio of two studies that assessed anxiety and depression in professionals working during the COVID-19 pandemic.

Reviews and Meta-Analyses – PRISMA (Moher et al., 2009).

2.1. Search strategy

The research and selection of studies were organized using the Population Variables Outcomes (PVO) strategy. In this model, the search strategy was defined according to Population (P), Variables (V) and Outcomes (O), with Mesh allocated in each category according to its search characteristic, with the purpose of optimizing the search: P – Health workers, V – COVID-19 and O – Mental Health.

Paper identification was completed via the keywords obtained by the Medical Subject Headings (MeSH), which is the National Library of Medicine controlled vocabulary thesaurus used for indexing papers for PubMed.

The following search terms were applied: “Covid-19” AND “Mental Health”; “COVID-19” AND “Health Workers” in titles and/or abstracts. Once studies were identified, the references were initially screened by applying the search criteria in the databases, using the following filters: studies performed since the beginning of the COVID-19 pandemic (December of 2019).

Once papers were filtered, their titles and abstracts were read in order to identify documents that mentioned the proposed theme of the review. The final step of screening (eligibility) for paper inclusion included two independent researchers reading the full papers. If there was disagreement on the inclusion of a specific paper, an additional reviewer was consulted for a final decision (once). The studies concluded this review process and in the event the researchers' decision was included, they would be assigned a table with the following

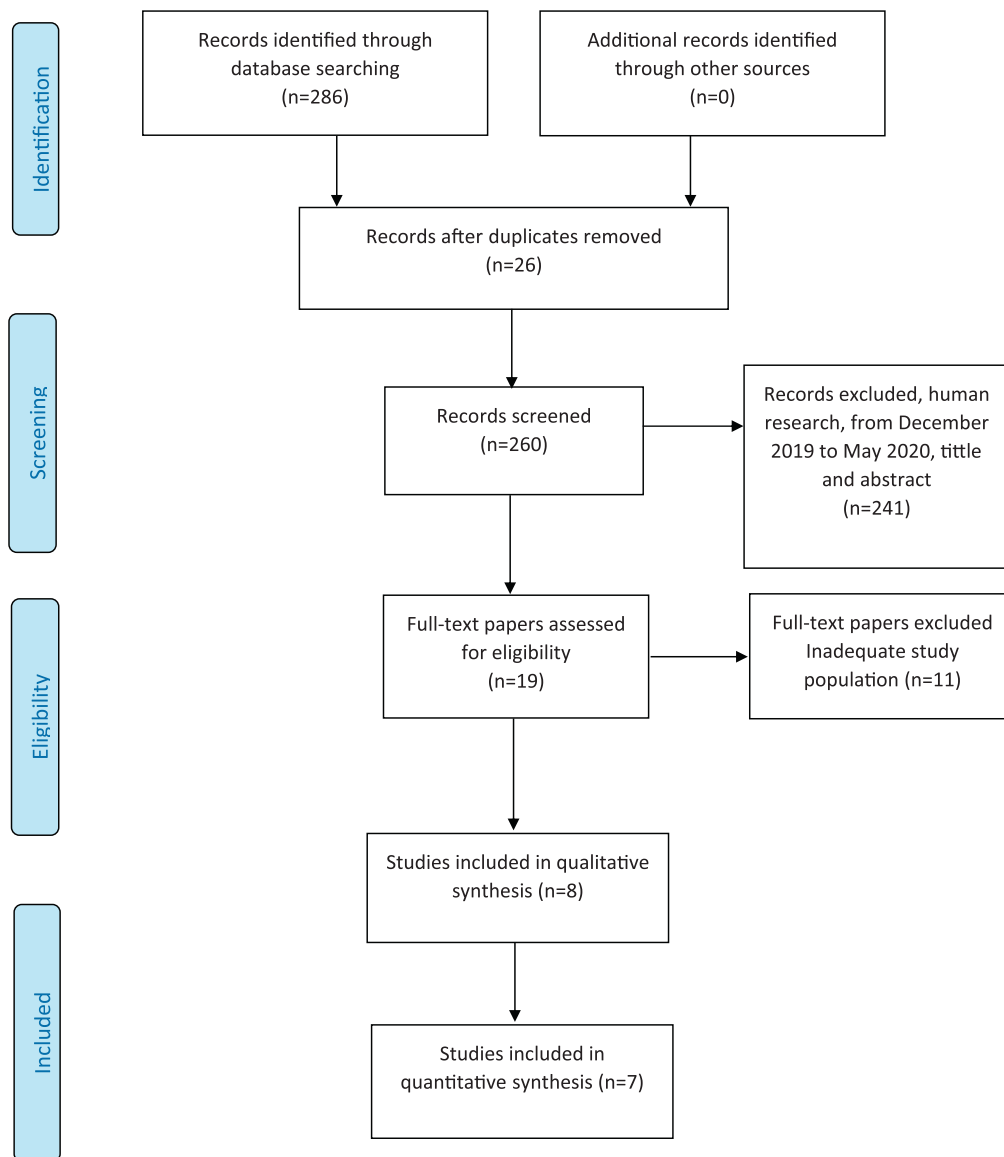


Fig. 3. Flowchart describing the search strategy and selection of studies using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

extracted information: Author and Year, Sample, Country, Collection Instrument (Questionnaire) and main conclusion in the order they were found in the databases.

2.2. Risk of bias data analysis

The funnel plot was used to test publication bias. In the presence of asymmetry, there may be bias and disagreements in the systematic review results (Fig. 1). This happens due to the short period for developing primary studies and also reflects on the scarcity of evidence available until now.

2.3. Study eligibility criteria

2.3.1. Patients (subjects)

We have included health professionals from the areas of knowledge (e.g. physicians, nurses, among others) part of a hospital context.

2.3.2. Variables

The only variable in our study was the time during the COVID-19 pandemic.

2.3.3. Outcomes

Professionals' mental health should be assessed using two previously validated questionnaires. Hence, the research instruments should provide data on the prevalence of mental disorders in the population studied. The main analyzed variables were anxiety, depression, insomnia, distress, and fear. Some observational studies of our sample divided the anxiety and depression levels into three levels: mild, moderate, and severe. Subjects with moderate and severe levels were gathered in only one group to categorize the presence and absence of anxiety symptoms during the COVID-19 pandemic.

2.3.4. Study design

The chosen references included observational studies with a cross-sectional outline.

2.3.5. Statistical analysis

We used RStudio statistical software, version 1.2.5033.0 and R version 3.6.2.27560. We have unified all the variable units and their main studied events. We developed forest graphs and calculated the randomized fixed effects using the statistical libraries of the Meta General Package for Meta-Analysis 4.11–0. Two studies with a smaller

Table 1
Description of the selected papers by author and year, location (country and cities), sample, instrument (questionnaire), and main.

Author and year	Sample	Location	Instrument	Main outcomes
Wu et al. (2020)	University students ($n = 2158$), health workers ($n = 2110$), hospitals in Wuhan ($n = 877$), hospitals out of Wuhan ($n = 1233$)	China (Wuhan)	Psychological Stress Questionnaire	During the COVID-19 outbreak period, medical teams, especially those in Wuhan, had a higher level of stress than university students. The anxiety and depression questionnaire scores for the medical team were higher during the outbreak compared to the non-outbreak period
Xu et al. (2020)	Health professionals ($n = 120$): before the increase of cases ($n = 60$) and during the increase of cases ($n = 60$)	China (Shanghai)	Anxiety scale, Depression score, Dream anxiety score, and SF-36 scale	The sudden increase of COVID-19 confirmed cases significantly increased anxiety, depression, and stress in the front-line medical team
Lu et al. (2020)	Health professionals ($n = 2299$), medical team ($n = 2042$), administrative team ($n = 257$)	China (Fujian Province)	Fear scale, HAMA, and HAM-D	Health professionals were 1.4 times more prone to feeling fear and suffering anxiety and depression
Zhang et al. (2020a)	Health workers ($n = 927$) and non-health workers (1.255)	China (cities non-specific)	ISI, PHQ-4, and SCL-90-R	During the COVID-19 outbreak, medical health workers had psychosocial problems and risks factors. Medical health workers showed higher prevalence rates of insomnia (38.4 vs. 30.5%, $p < 0.01$), anxiety (13.0 vs. 8.5%, $p < 0.01$), depression (12.2 vs. 9.5%, $p = 0.04$), somatization (1.6 vs. 0.4%, $p < 0.01$), and obsessive-compulsive symptoms (5.3 vs. 2.2%, $p < 0.01$) than non-medical health workers
Kang et al. (2020)	Health workers ($n = 994$)	China (Wuhan)	PHQ-9, GAD-7, ISI, and IES-R	36% of the medical team had subthreshold mental health dis, 34.4% had mild disturbances, 22.4% had moderate disorders, and 6.2% had severe disturbances
Liang et al. (2020)	Health workers ($n = 59$), COVID-19 department ($n = 38$), and another department ($n = 21$)	China (Zhuhai)	SDS and SAS	Overall, several staff were experiencing clinically significant depressive symptoms according to established threshold. There were no significant differences in scores between staff in COVID-19-associated and other departments
Lai (2020)	Health workers ($n = 1257$)	China (Wuhan)	PHQ-9, GAD-7, ISI, and IES-R scores	A large number of participants reported symptoms of depression (50.4%), anxiety (44.6%), insomnia (34.0%), and distress (71.5%)
Zhang et al. (2020b)	Health workers ($n = 1563$)	China (Wuhan)	PHQ-9, GAD-7, ISI, and IES-R scores	According to the used questionnaires, the medical team presented a prevalence of 36.1% for insomnia, 50.7% for depression, 44.7% for anxiety and 73.4% for stress related to the COVID-19 pandemic

GAD-7 = Generalized Anxiety Disorder; HAMA = Hamilton Anxiety Scale; HAM-D = Hamilton Depression Scale; IES-R = Impact of Event Scale-Revised; ISI = Insomnia Severity Index; PHQ-4 = Patient Health Questionnaire-4; PHQ-9 = Patient Health Questionnaire-9; SAS = Zung's self-rating anxiety scale; SCL-90-R = Symptom Check List-90-revised; SDS = Zung's self-rating depression scale.

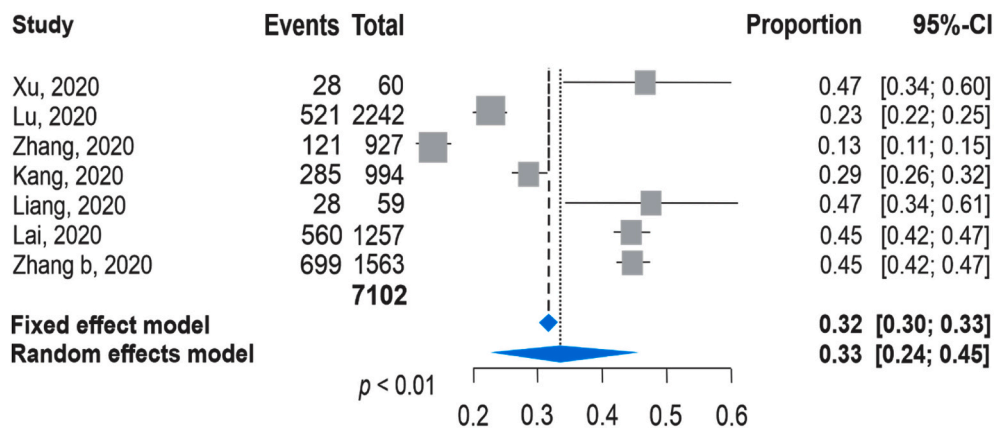


Fig. 4. Meta-analysis of anxiety in health professionals during the COVID-19 pandemic.

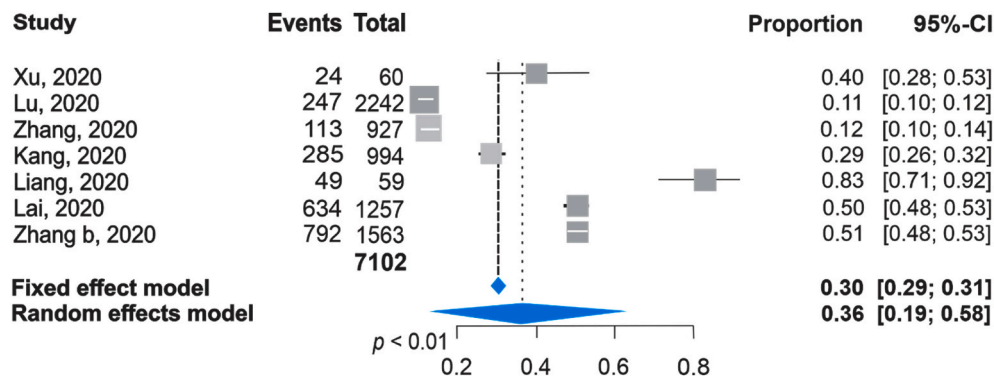


Fig. 5. Meta-analysis of depression in health professionals during the COVID-19 pandemic.

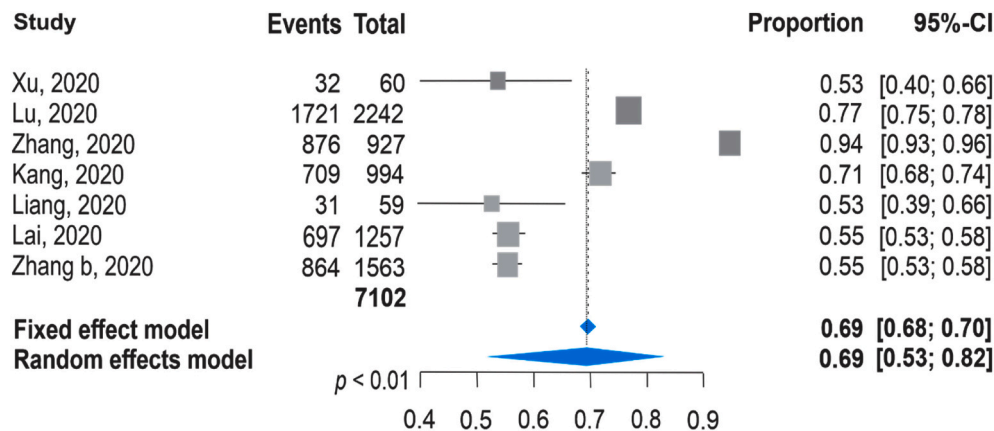


Fig. 6. Meta-analysis of anxiety in health professionals during the COVID-19 pandemic.

sample (Xu et al., 2020; Liang et al., 2020) were removed to analyze whether there were any alterations in the final effects, and the alteration was 0.04. Calculations with both studies resulted in 0.33 (95%CI 0.24 to 0.45, $p < 0.01$); and without both studies, it was 0.29 (95%CI 0.19 to 0.42, $p < 0.01$). MedCalc Version 19.2.0 was used to calculate the OR of Fig. 2.

3. Results

Study identification based on a search in the databases MEDLINE, BMJ, PsycINFO and LILACS resulted in 286 papers referring to the appropriate cited terms. After selecting papers through screening steps, 19 papers were eligible for reading. After the eligibility stage, only eight studies progressed to the final sample for this review. The number of

subjects who participated in the quantitative analysis was 7102 health professionals. The search process and selection phases are illustrated in the Flow Diagram following the PRISMA protocol Fig. 3 (Moher et al., 2009).

Description of the selected papers by author and year, location, sample, instrument, and main conclusions is shown in Table 1.

During the outbreak period, the levels of depression and anxiety shown by surgical teams were significantly higher compared to surgical teams during the non-outbreak period (OR = 1.8491; 95%CI 0.5117 to 6.6813; $p = 0.3483$ and OR = 7.8750; 95%CI 2.9432 to 21.0710; $p < 0.000$). Data from item 3 of Fig. 2 show that healthcare teams had higher levels of anxiety compared to administrative teams (OR = 1.2441; 95%CI 1.0834 to 1.4287; $p = 0.0020$), and there was no difference in the depression severity (OR = 1.0170; 95%CI 0.8494 to

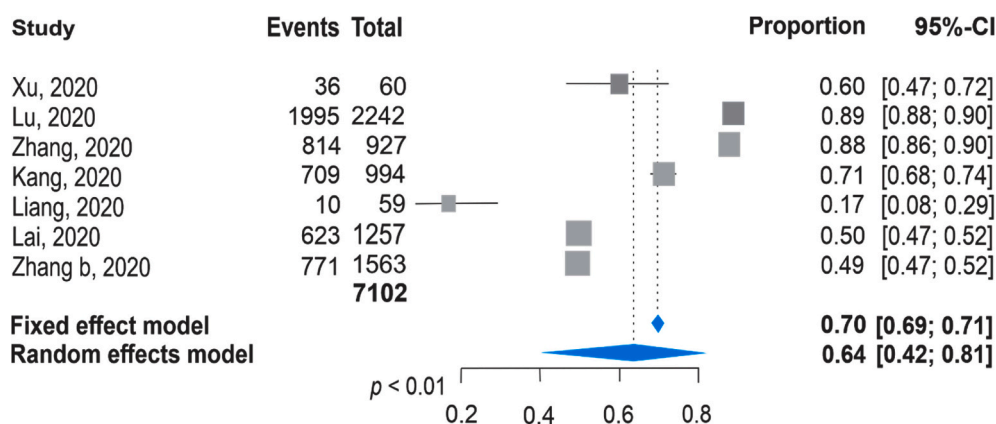


Fig. 7. Meta-analysis of non-depression in health professionals during the COVID-19 pandemic.

1.2178; $p = 0.8541$) between the medical staff and the administrative group.

In general, health professionals had a higher level of anxiety (13.0 vs. 8.5%, $p < 0.01$, OR = 1.6152; 95%CI 1.3283 to 1.9641; $p < 0.0001$) and depression 12.2 vs. 9.5%; $p = 0.04$; OR = 1.3246; 95%CI 1.0930 to 1.6053; $p = 0.0042$), besides somatizations and insomnia compared to professionals from other areas.

Younger medical teams (age ≤ 30) had higher scores than older teams; however, this difference was not statistically significant for anxiety or depression (OR = 1.0878; 95%CI 0.4867 to 2.4313; $p = 0.8375$ and OR = 1.0846; 95%CI 0.4921 to 2.3906; $p = 0.8403$).

Data used to calculate item 5 in Fig. 2 were extracted from an observational study of insomnia. Health professionals with insomnia were more prone to develop anxiety and depression symptoms (OR = 13.5517; 95%CI 10.4771 to 17.5285; $p < 0.0001$). Most of them also spent ≥ 5 h reading information on the COVID-19 outbreak during the week and they have considerable uncertainty about the disease and its effective control.

In the study by Kang et al. (2020), it was not possible to calculate it, because it was a quantitative study in which they used questionnaires, but there was no comparison among study subjects.

The randomized effect model was 0.33 (95%CI 0.24 to 0.45; $p = 0.01$) in Fig. 4, whereas it was 0.36 (95%CI 0.19 to 0.58; $p = 0.01$) in Fig. 5. Both values are considered low, but statistically significant.

Weights were calculated based on the analysis of randomized effect in Fig. 6 and resulted in 0.69 (95%CI 0.53 to 0.82; $p < 0.01$) and then in 0.64 (95% CI 0.42 to 0.81; $p < 0.01$), as in Fig. 7. These are quite high scores for the non-development of anxiety and depression; however, we should consider all the reasons for the odds from Fig. 2, the sampling differences, and scarcity of high evidence until now.

4. Discussion

This study aimed to assess the outcome of the COVID-19 pandemic scenario on the mental health of health professionals. The main results found were: a) Health professionals showed high prevalence of mental disorders; b) During the pandemic, the anxiety and depression scores are significantly higher in the healthcare teams; c) The teams working closer to infected patients showed a higher prevalence of mental disorders.

According to comparative analyses in primary studies (Figs. 4 and 5), samples with anxiety and depression may not be clearly present in most of the health professionals at this pandemic situation, but there are great odds of their increase due to this and other pandemics (Liang et al., 2020; Xu et al., 2020; Lu et al., 2020; Zhang et al., 2020a, 2020b).

The levels of depression and anxiety shown by health professionals was significantly higher during the outbreak (Xu et al., 2020) mainly due to stress, insomnia, fear of the disease and infectiousness (Lu et al.,

2020; Zhang et al., 2020b). Similarly, studies carried out during and after epidemics like 2003 SARS and 2014 Ebola observed changes in behavior induced by these disorders (Shultz et al., 2016).

We found many psychiatric disorders like anxiety, depression, and posttraumatic stress in health professionals during and after pandemics (Blakey et al., 2019; Gardner and Moallem, 2015; Mak et al., 2009). It is noteworthy that this population especially has a higher chance of evolving to more severe conditions of the disease, considering that the infection caused by a high viral load results in a worse prognosis for SARS-CoV-2 (Liu et al., 2020). Higher exposure to infected patients favors disease spread (Yu et al., 2020).

In addition, healthcare teams with insomnia are more susceptible to developing the disorders mentioned. In the study performed by Zhang et al. (2020a, 2020b), 1563 subjects were assessed using a questionnaire that measured the insomnia score. Among the subjects assessed, the population that showed insomnia ($n = 564$) had a significantly higher prevalence of anxiety and depression in a moderate and severe way. It is noteworthy that the COVID-19 pandemic is a worsening factor that increases the number of insomnia cases among health professionals (Zhang et al., 2020a, 2020b).

Some studies compared the mental disorders suffered by healthcare teams to those suffered by professionals from other areas. Anxiety, fear, and depression were substantially higher in health professionals mainly because they are more exposed to infection, unlike professionals from other areas (Lu et al., 2020). Age was not associated with the development of disorders during the pandemic and this study might be a reminder to not neglect the mental health of health professionals by age. The study may also provide evidence that this is not a strong predictor for psychological disorders in pandemics (Liang et al., 2020).

The main limitation of the results of this study was that all the studies included in this paper were carried out in China. Thus, the mental health characteristics cannot be extrapolated to the rest of the world, considering that each country has a different scenario for fighting the COVID-19 pandemic, which can be more favorable or not compared to the one found in China.

We strongly recommend that other studies be carried out in other countries in order to clarify the pandemic effects on healthcare teams in each affected region. In addition, we hope to strengthen the discussion on the need for healthcare teams to be followed by other professionals, to avoid worse prognoses on mental health.

5. Conclusion

During the COVID-19 pandemic, health professionals, regardless of their age, showed significant levels of mental disorders, which were higher compared to other periods. In the analyzed studies, we observed a prevalence of anxiety and depression, and insomnia was a risk factor for both.

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Authors contributions

FCTS and MLRN designed the review, developed the inclusion criteria, screened titles and abstracts, appraised the quality of included papers, and drafted the manuscript.

MLRN and FCTS reviewed the study protocol and inclusion criteria and provided substantial input to the manuscript.

MLRN and FCTS reviewed the study protocol. MLRN read and screened articles for inclusion. All authors critically reviewed drafts and approved the final manuscript.

Declaration of Competing Interest

The authors declare that they have no competing interests.

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